Correlation between Chronic Non-Specific Neck Pain and Lumbar Reposition Sense: a correlative study*.

Mohammed H. Abdelaziz[1], Neveen A. Abdelraoof [2], Ahmed A. Habib[3]

[1]Department of Basic Sciences, Faculty of Physical Therapy, Cairo University, Cairo, Egypt

ABSTRACT

Background: *Chronic nonspecific neck pain is a very common, costly health problem with a major impact on the quality of life related to health. There has been much more importance placed on the need for a good comprehension of the relationship between chronic nonspecific neck pain and lumbar reposition sense to institute comprehensive management strategies that deal with not only cervical but also lumbar spine problems.* ***Purpose:*** *This study aimed, to evaluate the correlation of chronic non-specific neck pain and lumbar reposition sense.* ***Methods:*** *The mean value of age of the participants was 27.41 ± 5.4 years; the average body mass index was 22.93 ± 1.4 kg/m², and the duration of neck pain had been 26.84 ± 21.3 weeks. The study had a total of 74 patients who were diagnosed with chronic non-specific neck pain lasting for as a minimum 12 weeks. Assessments for the lumbar repositioning sense error in both standing and sitting positions among the respondents were carried out using an iPhone® inclinometer app, while the level of pain in the neck was assessed using the Visual Analogue Scale (VAS). Results: Both the standing (r= 0.8, p=0.001) and sitting (r= 0.85, p=0.001) repositioning error scores of the lumbar repositioning sense were found to be strongly directly linearly correlated with the score obtained with the neck pain intensity.* ***Conclusion:*** *With the use of the iPhone inclinometer as the assessment tool, this study has shown a strong direct relationship between chronic non-specific neck pain and the lumbar reposition sense.*

Keywords: *Chronic non-specific neck pain, lumbar reposition sense, iPhone®□ inclinometer app.*

INTRODUCTION

Chronic non-specific neck pain (CNSNP) is an ailment suffered by the vast majority of the world's population and is even a recognized risk linked to major health conditions because of the influence exerted on quality of life, work, and healthcare resources [1-3]. CNSNP is the pain perceived in the back of the neck region and the cervical spine, which is not having any identifiable specific cause [4]. The prevalence and recurrent nature of this condition underline its being a purely physical, psychological, and environmental factor in its complexity to yield a complex clinical presentation that resists conventional treatment paradigms [5, 6].

Further, the functional limitations and disabilities resulting from CNSNP seem not to emanate from the cervical region alone but to be affected from other areas of the spine, notably the lumbar region [7, 8]. The interplay of cervical and lumbar dysfunctions in CNSNP patients has not been recognized previously by prevailing research or trial, especially in relation to the lumbar reposition sense as a part of proprioception [9-11]. Proprioception is defined as "the body's ability to sense its location, movements, and actions in space and in regard to spatial orientation and movement in regards to balance and maintenance of posture" [12, 13].

Recent research has begun to explore the potential link between CNSNP and lumbar proprioceptive function [14]. This is further supported by growing evidence that impairs lumbar and thoracic spine proprioception, maybe worse or more pernicious, result in the persistence of neck pain and lead to a vicious circle of pain and dysfunction [15]. This study aims to fill the gap by looking into the relationship between CNSNP and the lumbar reposition sense and in the process provide further insights that may result in comprehensive models of the management of CNSNP.

METHODS

Study Design and Setting

This correlative study was conducted at the Faculty of Physical Therapy, October University For Modern Science And Arts from October 2023 to February 2024. The study protocol was registered with the Faculty Research Ethics Committee (approval number: P.T.REC/ 012/004963) and Clinical Trials of Registration (NCT06353802).

Participants

The sample size was calculated using the G*Power software (version 3.0.10). Correlation point biserial model was selected. Considering a power of 0.80, an α level of 0.05 (2-tailed), and an effect size of 0.33; a generated sample size of at least 67 participants was required, adding 7 subjects (10%) as drop out, so total sample size is 74 subjects

Seventy-four participated, with an average age of 27.41 ± 5.4 years, a body mass index of 22.93 ± 1.4 kg/m², and a neck pain duration of 26.84 ± 21.3 weeks. Participants were recruited from the outpatient clinics on the Faculty of Physical Therapy, October Univerisity For Modern Science And Arts. Inclusion criteria covered adults aged 18-50 years with a diagnosis of persistent non-precise neck pain lasting for as a minimum 12 weeks. Exclusion criteria had been radiated neck ache, neck pain related to vertigo, history of decrease limb or returned surgical procedure, current trauma, neurological or vestibular disorders, metabolic illnesses, and use of medications affecting balance 24 hours earlier than evaluation.

. Instrumentation

Lumbar reposition sense was measured using the iPhone® Inclinometer application (Apple Inc., Cupertino, CA,

USA). This app has shown high reliability and accuracy for spine posture assessment in previous studies [16] . Pain intensity was assessed using the Visual Analog Scale (VAS), a commonly used metric in pain research [17] .

Assessment Procedures

The sense error of lumbar repositioning was assesed through using both standing and sitting positions. The study was completed with the subjects beginning in the neutral posture of their spine; then they were asked to flex forward to a pre-set angle and return to the original position. This process was repeated three times, and the mean error from the target position was recorded for analysis.

Data Analysis

The software used for the statistical analysis was the Statistical Package for Social Sciences (SPSS) version 22 (IBM Corp, Armonk, NY, USA). Descriptive statistics for all variables were computed. The Pearson correlation coefficient was applied to find out the relationship between the intensity of neck pain, represented in VAS scores, and errors in lumbar repositioning in angles. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Participant Characteristics

The demographic and clinical characteristics of the participants are summarized in Table 1. The study included 74 patients with CNSNP, with a mean age of 27.41 ± 5.4 years, a body mass index of 22.93 ± 1.4 kg/m², and a neck pain duration of 26.84 ± 21.3 weeks.

Table 1: Characteristics of Participants

Characteristic	Mean	Standard Deviation
Age (years)	27.41	5.4
Body Mass Index (kg/m²)	22.93	1.4
Duration of Neck Pain (weeks)	26.84	21.3
VAS Score (0-10 scale)	4.92	2
Standing Lumbar Repositioning Error (degrees)	4.56	2.1
Sitting Lumbar Repositioning Error (degrees)	4.34	2

Correlation Between Neck Pain and Lumbar Repositioning Sense

The analysis revealed a strong positive linear correlation between the Visual Analogue Scale (VAS) scores for neck pain and lumbar repositioning sense error in both standing and sitting positions. The results are detailed in Table 2 and illustrated in Figures 1 and 2.

Table 2: Correlation between Neck Pain VAS Score and Lumbar Repositioning Sense Error

Position	Correlation Coefficient (r)	p-value
Standing	0.8	0.001
Sitting	0.85	0.001

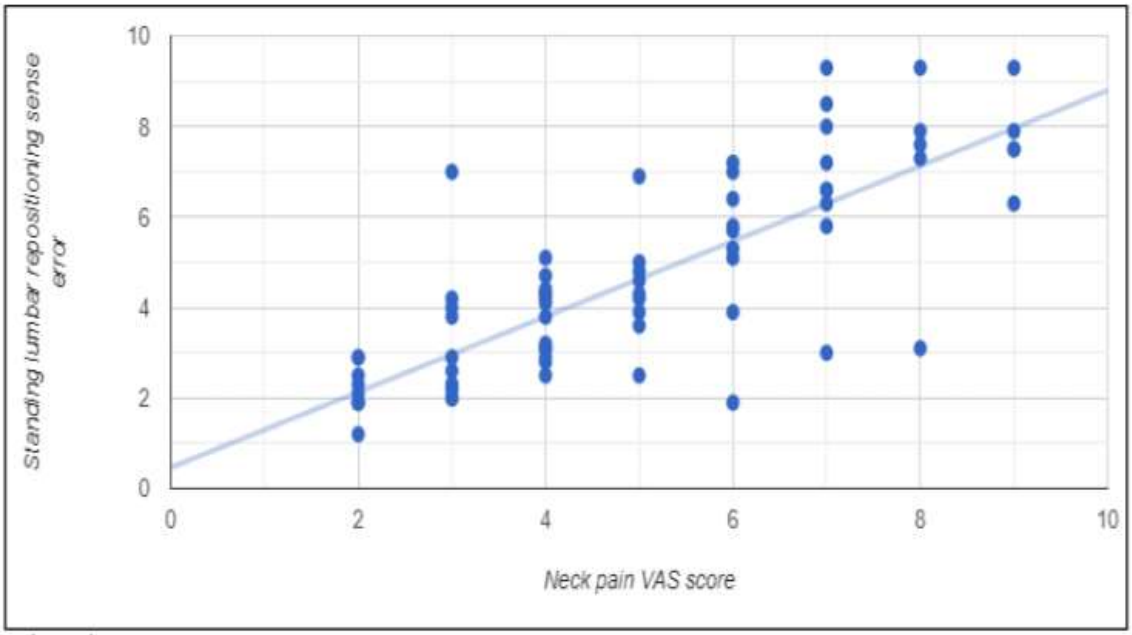

Figure 1: Scatter plot illustrating the correlation between neck pain VAS score and standing lumbar repositioning sense error.

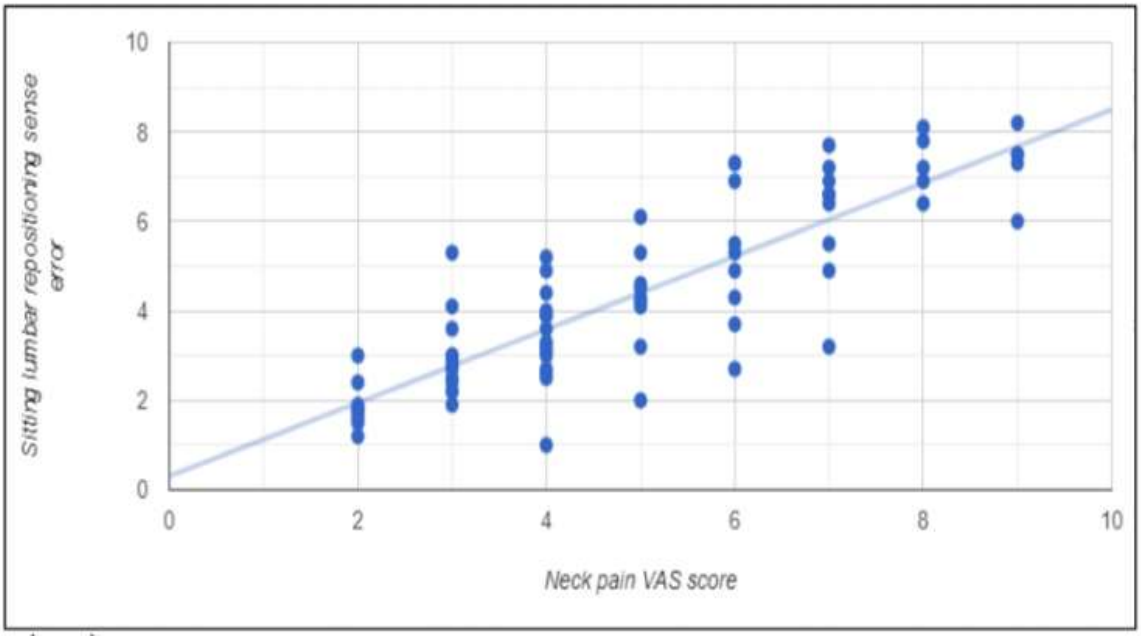

Figure 2: Scatter plot illustrating the correlation between neck pain VAS score and sitting lumbar repositioning sense error.

In both positions, the correlation coefficients indicated statistically significant relationships (standing: r=0.8, p=0.001; sitting: r=0.85, p=0.001), suggesting that higher levels of neck pain were associated with greater errors in lumbar repositioning sense.

CONCLUSION

The result of the study reflected a strong direct correlation between CNSNP and errors in lumbar repositioning sense, hence showing large significant effects of cervical discomfort on lumbar proprioception. This correlation is in line with the concept that dysfunctions in one part of the spine may, therefore, impact or be impacted by the sensory and motor functions of others and be able to produce or exacerbate pain symptoms from this baseline of abnormal functioning in multiple regions [18,19].

Degraded proprioception has been suggested in prior research to contribute to the feeling of musculoskeletal pain, such as chronic low back pain. Thus, our findings are supporting this and bringing light to the highly understudied interaction of cervical and lumbar regions that suggest issues related to the spine should be considered holistically.

For instance, Lee et al. (2015) revealed that, in the 41 subjects presenting with neck pain for the research, there existed statistically significant relationships between the angle of pelvic tilt and performance during neck repositioning [19]. Abd-Elshafy et al. (2022) also confirmed that, after their examination of 288 school children, they were able to reveal that there was an appreciably strong relationship between neck pain and trunk extensor endurance [20]. Moreover, thoracic repositioning angles have been shown by Lau et al. To be moderately related to the severity of neck pain from which one can indicate that this variable can potentially be a part of the diagnostic process [15]. In addition, Moseley (2004) reported that impaired control of muscles of the trunk was evident in 54 patients with neck pain, where it is noted to be related to the increased risk of low back pain [14].

This was further supported by Salahzadeh et al., who found significant differences in the endurance of trunk muscles in the pain group as compared with controls when assessing 97 subjects with forward head posture and neck pain [21]. However, Onan et al. (2023) and Ali et al. (2022) highlighted that, respectively, most of the disability and pain were significantly reduced after delivering the targeted intervention among patients with CNSNP at 3 months of follow-up in both groups: specific lumbar stabilization exercise in group A and core strength training in group B [22,23].

Interpreting the Findings

Thus, this is one association of increased VAS scores with large lumbar repositioning errors that further supports the underlying hypothesis of a CNSNP effect on, or by, the sensory feedback mechanisms that would govern position sense. This relationship may support the possibility of an impaired proprioceptive feedback loop occurring in the lumbar spine of patients with current neck pain, either through alternate changes brought about by motor control strategies, or the contribution of central sensitization phenomena. Changes in the pattern of muscle activity could lead to patients using compensatory movements that increased the mechanical stress on the lumbar spine [14, 18].

Implications for Treatment

The present results drew attention to the possibility of including a targeted lumbar proprioceptive exercise as a part of the rehabilitation program in CNSNP patients. Although treatment using traditional therapeutic interventions is directed at the site of pain, since the spine is a continuous system, improvements in proprioceptive deficits from treatment might contribute to general treatment effectiveness. For instance, exercises that enhance lumbar proprioceptive accuracy might not only diminish errors made by lumbar movements but may also avert the occurrence of neck pain via stabilization in the chain of interdependent spinal segments [22, 23].

Limitations and Future Research

The study is, however, not free from a few constraints. The design was cross-sectional in nature, and hence causal inferences could not be drawn from the same. Longitudinal studies have to be taken up to measure the directionality of the relationships observed. Besides, even if it is innovative and functional with an iPhone® inclinometer, the reading of the proprioceptive accuracy measurement is probably less accurate compared to the one taken with much more delicate and sophisticated biomechanical equipment. Determination of the mechanisms that correlate these factors in future research will be necessary, possibly including in one study neurophysiological techniques for the

assessment of adaptations of the nervous system in patients with CNSNP.

CONCLUSION

The outcome of this study proved a strong direct relationship between CNSNP and errors in lumbar repositioning sense. It therefore shows the significance of interaction between cervical and lumbar proprioceptive functions. An easy-to-use iPhone® inclinometer application was used in determining that increased intensity of the pain neck is associated with larger lumbar positioning errors during standing and sitting position. Therefore, means that CNSNP could influence the proprioceptive feedback system of the lumbar spine. Considering this, further research should be carried out with respect to the implementation of lumbar proprioceptive training within rehabilitation programs intended for CNSNP with the main purpose of enhanced treatment efficacy. Such findings motivate comprehensive assessment and treatment approaches in the management of spinal disorders, with a possibility of improving outcomes for patients with chronic spinal pain.

Source of funding: T
his research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest:

The authors declare that they have no competing interests.

Author contribution:

The authors contributed equally to the study.

Acknowledgment:

The authors would like to thank the participants in this study.

REFERENCES

Palacios-Ceña, D., Alonso-Blanco, C., Hernández-Barrera, V., Carrasco-Garrido, P., Jiménez-García, R., & Fernández-de-las-Peñas, C. (2015). Prevalence of neck and low back pain in community-dwelling adults in Spain: an updated population-based national study (2009/10-2011/12). European Spine Journal : Official Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society, 24(3), 482–492.

1. Cerezo-Téllez, E., Torres-Lacomba, M., Fuentes-Gallardo, I., Perez-Muñoz, M., Mayoral-Del-Moral, O., Lluch-Girbés, E., Prieto-Valiente, L., & Falla, D. (2016). Effectiveness of dry needling for chronic nonspecific neck pain: a randomized, single-blinded, clinical trial. Pain, 157(9), 1905–1917.
2. Lamé, I. E., Peters, M. L., Vlaeyen, J. W. S., Kleef, M. V., & Patijn, J. (2005). Quality of life in chronic pain is more associated with beliefs about pain, than with pain intensity. European Journal of Pain, 9(1), 15–24.
3. Misailidou, V., Malliou, P., Beneka, A., Karagiannidis, A., & Godolias, G. (2010). Assessment of patients with neck pain: a review of definitions, selection criteria, and measurement tools. Journal of Chiropractic Medicine, 9(2), 49.
4. Blanpied, P. R., Gross, A. R., Elliott, J. M., Devaney, L. L., Clewley, D., Walton, D. M., Sparks, C., & Robertson, E. K. (2017). Clinical practice guidelines linked to the international classification of functioning, disability and health from the orthopaedic section of the American physical therapy association. Journal of Orthopaedic and Sports Physical Therapy, 47(7), A1–A83.
5. Cohen, S. P. (2015). Epidemiology, diagnosis, and treatment of neck pain. Mayo Clinic Proceedings, 90(2), 284–299.
6. Bogduk, N., & Macintosh, J. E. (1987). 1987 volvo award in basic science: The morphology of the lumbar erector spinae. Spine, 12(7), 658–668.
7. Gracovetsky, S. (1985). An hypothesis for the role of the spine in human locomotion: a challenge to current thinking. Journal of

Biomedical Engineering, 7(3), 205–216.

8. Fujii, R., Sakaura, H., Mukai, Y., Hosono, N., Ishii, T., Iwasaki, M., Yoshikawa, H., & Sugamoto, K. (2007). Kinematics of the lumbar spine in trunk rotation: in vivo three-dimensional analysis using magnetic resonance imaging. European Spine Journal : Official Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society, 16(11), 1867–1874.
9. Steffen, T., Rubin, R. K., Baramki, H. G., Antoniou, J., Marchesi, D., & Aebi, M. (1997). A new technique for measuring lumbar segmental motion in vivo. Method, accuracy, and preliminary results. Spine, 22(2), 156–166.
10. Izzo, R., Guarnieri, G., Guglielmi, G., & Muto, M. (2013). Biomechanics of the spine. Part I: Spinal stability. European Journal of Radiology, 82(1), 118-126.
11. Hoffman, M., & Payne, V. G. (1995). The effects of proprioceptive ankle disk training on healthy subjects. The Journal of Orthopaedic and Sports Physical Therapy, 21(2), 90–93.
12. Lephart, S. M., Pincivero, D. M., Giraldo, J. L., & Fu, F. H. (1997). The role of proprioception in the management and rehabilitation of athletic injuries. The American Journal of Sports Medicine, 25(1), 130–137.
13. Moseley G. L. (2004). Impaired trunk muscle function in sub-acute neck pain: etiologic in the subsequent development of low back pain?. Manual therapy, 9(3), 157–163 .
14. Lau, K. T., Cheung, K. Y., Chan, K. B., Chan, M. H., Lo, K. Y., & Wing Chiu, T. T. (2010). Relationships between sagittal postures of thoracic and cervical spine, presence of neck pain, neck pain severity and disability. Manual Therapy, 15(5), 457–462.
15. Kolber, M. J., Mdt, C., Pizzini, M., Robinson, A., Yanez, D., & Hanney, W. J. (2013). The reliability and concurrent validity of measurements used to quantify lumbar spine mobility: an analysis of an iphone® application and gravity based inclinometry. International Journal of Sports Physical Therapy, 8(2), 129. /pmc/articles/PMC3625792/
16. MacDowall, A., Skeppholm, M., Robinson, Y., & Olerud, C. (2018). Validation of the visual analog scale in the cervical spine. Journal of Neurosurgery. Spine, 28(3), 227–235. Myers, T. W. (2009). Anatomy trains: myofascial meridians for manual and movement therapists. Elsevier Health Sciences.
17. Black, K. M., McClure, P., & Polansky, M. (1996). The Influence of Different Sitting Positions on Cervical and Lumbar Posture. Spine, 21(1), 65–70.
18. Lee, H. S., Chung, H. K., & Park, S. W. (2015). Correlation between Trunk Posture and Neck Reposition Sense among Subjects with Forward Head Neck Postures. BioMed Research International, 2015, 1–6.
19. Abd-Elshafy, A. H., El-Meniawy, G. H., Abu El Azm, W. S., & El Fakharany, M. S. (2022). The relation of forward head posture with back muscle endurance in primary school children: a cross-sectional study. Bulletin of Faculty of Physical Therapy, 27(1) .
20. Salahzadeh, Z., Rezaei, M., Adigozali, H., Sarbakhsh, P., Hemati, A., & Khalilian-Ekrami,

N. (2020). The Evaluation of Trunk Muscle Endurance in People with And Without forward Head Posture:a Cross Sectional Study. Muscle Ligaments and Tendons Journal, 10(04), 752.

21. Onan, D., Ulger, O., & Martelletti, P. (2023). Effects of spinal stabilization exercises delivered using telerehabilitation on outcomes in patients with chronic neck pain: a randomized controlled trial. Expert Review of Neurotherapeutics, 23(3), 269–280.
22. Ali, A. F. M., Shabara, A. R. A., Elrazik, R. K. A., & Samir, S. M. (2022). Effect of adding trunk core training exercise to conventional therapy on patients with chronic mechanical neck pain. International Journal of Health Sciences, 8524–853.